THE BLACKWALL REACH CLIFFS, SWAN RIVER

By J. GENTILLI and V. N. SERVENTY

The Swan River, after having filled the broad expanse known as Melville Water, enters a narrow gap known as Blackwall Reach. This gap extends over a length of less than a mile and its width is about a quarter of a mile. The accompanying locality map (Fig. 1) shows that the gap cuts through a low hill which still reaches over 150 feet at its highest points, on both sides of the river.

It was decided to make a preliminary survey of Blackwall Reach because of the possibility of finding caves and terraces or other results of past river levels. Interesting recent fossils had been found by previous investigators at Mosman Bay (about half a mile upstream) and at Minim Cove (at the downstream exit of Blackwall Reach, on the north side) and it was not excluded that some more fossils might be found in the cliffs of Blackwall Reach.

The contours on the locality map have been taken from the map of the Perth metropolitan area recently published by the Lands Department for the purposes of regional planning. They show the steep sides of the gap, but cannot bring out the existence of the cliffs because most of these cliffs only extend to or very little above the first contour of 25 feet.

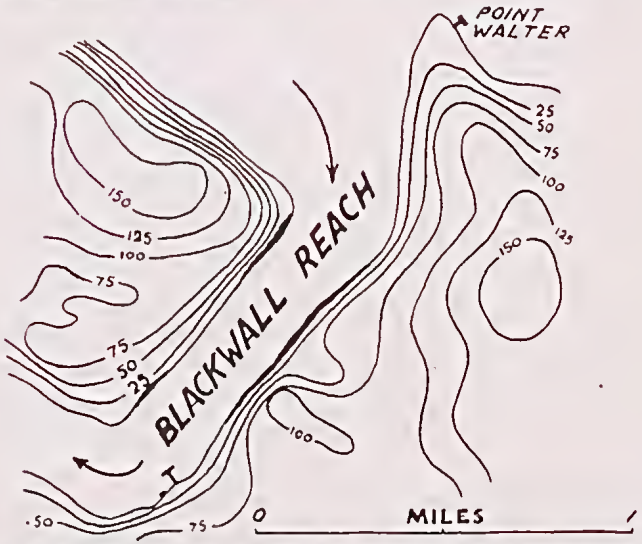


Fig. 1. Locality map, based on various maps published by the Lands Department, Western Australia. The thick line shows the approximate position of the main cliffs and the arrows the direction of river flow.

On the south side of the river the height of the cliffs varies from a few feet to over 25 feet, mostly around 20 feet. The formation consists of siliceous grains (quartz) of various sizes, imbedded in limestone. The erosion forms are those characteristic of limestone, but the physical behaviour of the residual material varies

according to the size of the quartz grains, which range from less than 0.2 mm. to 3 mm. in diameter.

The cliffs are caused by the eroding work of the river, which flows from the wide expanse of Mosman Bay into the narrow gap, deepening the bed and carrying any material in suspension farther downstream, or else depositing it against the opposite shore, which has consequently developed a gentler slope near the water level and shows plentiful recent deposition of fine alluvial material. Against the cliffs on the southern side of Blackwall Reach, on the contrary, there is no deposition at all at present, and plenty of evidence of erosive work. The river almost reaches its greatest depth here.

As may be expected under the rainfall of the region, about 30 inches a year, the limestone has been deeply attacked physically and chemically. Sharp points and ledges are very frequent.

Physical and chemical erosion has led to the formation of at least one long and narrow cave. The main factor has probably been the seepage of acidic rainwater through the overlying soils (partly

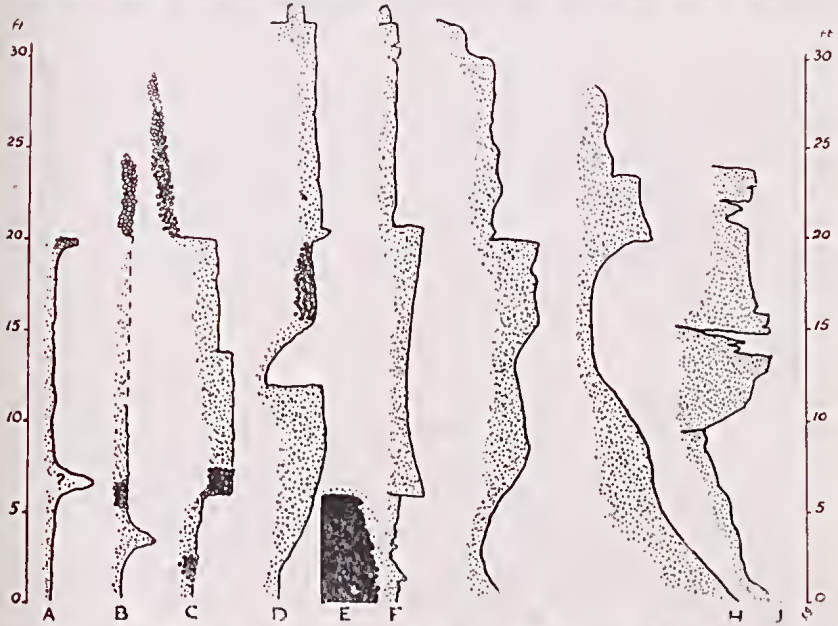


Fig. 2. Typical profiles of cliffs at Blackwall Reach. A (towards the upstream end of the cliffs, south side) shows grit and ledge at 20 feet, ledge of unknown material at about 7 feet. B and C show grit at 20 feet and at about 6-7 feet, C shows steps at 20 and 14 feet and undercut with grit at 6 feet. D shows the highest point on the cliffs, with a level at about 35 feet, a slight undercut underlain by grit at 20 feet, a deep undercut at 12-14 feet. E shows the right-hand side of the cave's entrance; notice the height of the cave, 6-7 feet. F shows the cliffs in the vicinity of the cave, with levels at 28-30 feet and 20 feet and undercut at about 6 feet. G is a profile from the north side of the river, with a terrace at 20 feet, above which shells were found. H shows an undercut at 20 feet, where numerous thin shells were also found. J is more heavily weathered, but shows interesting features at 10, 14, 20 and 24 feet.

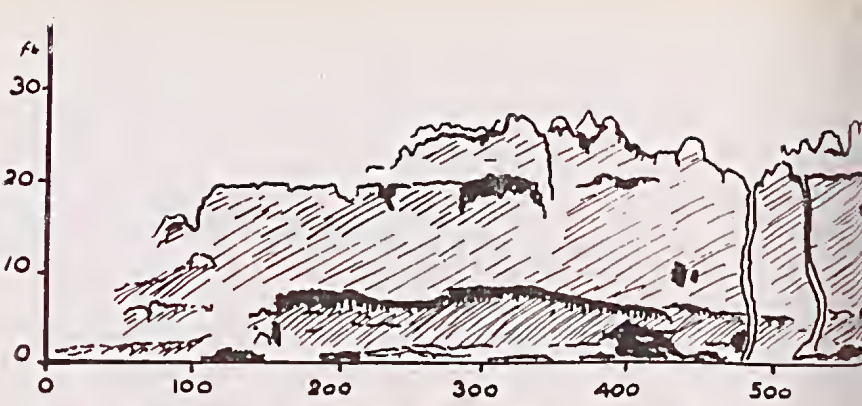


Fig. 3. The cliffs on the south side, as they appear from the north side, near the entrance to the Reach. The vertical scale is exaggerated. Notice that very few remnants of the cliffs are over 25 feet. The 20-foot level is very clearly shown. The undercut is found at about 7 feet in the upstream section, and gradually goes down to little over 5 feet downstream; the undercut corresponds to the lower grit layer, visible because of its yellowish tinge against the whitish limestone.

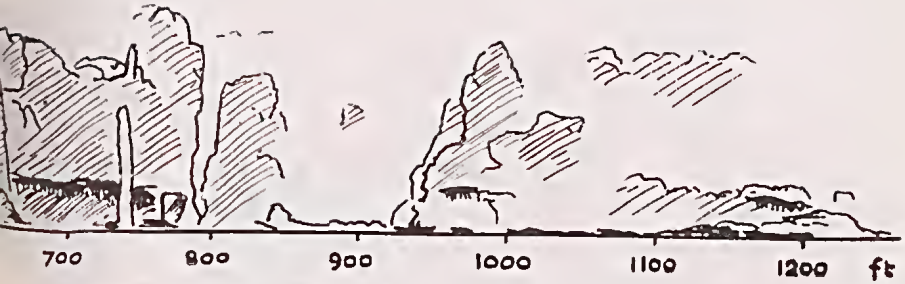
podsolized in places, akin to typical *terra rossa* at other points). The influence of these soils is also felt through the accumulation of fine red cave clay on the floor and the roof of the cave.

The cave extends in a direction generally perpendicular to that of the wall, with a bearing of about 100°; the measured length is over 180 feet, but after this distance had been measured the cave was still found to continue without any reduction in size. The average height is mainly around 4 feet, varying in places between 2 and 6 feet. The average width is little greater. No stalagmites were observed, and very few and very small stalactites. Some small shawl formations occur in places. Slabs of calcite with minute crystals occur especially on the floor. Rock falls from the roof are frequent and almost obstruct the passage at places. The entrance to the cave is partly flooded, and water covers the floor irregularly for the first 30 or 40 feet. However even after some very rainy days no evidence of an underground stream was found.

The cliffs on the south side of the river show evidence of various water levels which left their mark on the limestone. At a few places horizontal levels about 20 inches below the water, and more limited horizontal levels about 1 and 2 feet above the water were clearly noticeable. Some of the smaller level areas might well be the upper faces of fallen rocks, but it is most unlikely that so many rocks would fall with their upper sides perfectly smooth and horizontal.

A loose piece of rock at water level had plentiful fossil shells identical with those of the Minim Cove deposits, almost opposite on the northern side of the river. Other fossils were noticed about 2 feet above water level.

A layer of very coarse sand was noticed at a few places at over 7 feet from the water, as shown in Fig. 2. The most interesting



feature however was a layer of extraordinarily coarse grit found at over 20 feet above the water, with traces of shells. Although the shell fragments could have been blown about by the wind, especially in a narrow gap, it would have been impossible for the wind to shift the heavier quartz grains which reached 2 to 3 mm. in diameter. The origin of this grit is worth discovering, because one of the writers (J.G.) has noticed very similar grit on the west shore of Lake Jandakot, also on the coastal plain, at a place where the nearest source of quartz grit is several miles away. A sudden flood by a rushing torrent is the only explanation that can be offered at present. Profiles A to D, all from the southern side of the river, show the position of the grit layer.

Most of the cliffs end at about 20 feet, but in a few places they reach over 25 feet, and a beautiful frieze-like mould of *Patella*-type shells was noticed at about 28 feet from the water level. The shells must have been imbedded in the original sand at the bottom of very smoothly flowing water, because they formed a very regular line and lay with the concave side downwards. The regularity of the pattern excludes the possibility of wind action at the time the shells were first imbedded in the sand.

The greatest height is reached with a small remnant estimated to be at 35 feet above which is a thin pinnacle (profile D of Fig. 2).

A study of the slopes on the north side of the Reach showed some cliff remnants, typical profiles being shown in Fig. 2, G to J. Profile G refers to the cliff near the downstream end of the Reach; shells were found imbedded in the rock at about 20 feet from the water. Profile H shows the cliff near the entrance of the Reach, where a large number of small shells was found in almost loose sand also at about 20 feet from the water. No fossils were noticed in the cliff shown at J.

Further investigation of the slopes above the cliffs showed some coarse sand at 60 and 90 feet from the water. It is not possible to find out whether this coarse sand was originally deposited by the waves and consolidated as beach rock, or whether it was blown on to an existing dune by the wind. The great height and the type of sand would rather suggest wave action, but wind action cannot be excluded.

Summing up, evidence of recent marine action (shell deposition) was noticed at 28 feet from water level. Supposed remnants of a 25 foot eroded platform were also found. Very coarse quartz grit was found on the south side of the Reach at about 20 feet, a definite ledge was noticed at that height on both sides, and shells were found at the same height on the north side.

The cliffs of Blackwall Reach contribute to the beauty of the river, and it is hoped that roads and houses will not interfere with them. No projected "Blackwall Reach Parade" will equal the beauty of the narrow track that now runs over the top of the southern cliffs.

In closing, thanks are expressed to Mr. Eric Strauss, who took part in some of the excursions to the Reach and repeatedly assisted with transport and measurements.

THE SPREAD OF THE MEDITERRANEAN SNAIL *(Helix pisana)* ON ROTTNEST ISLAND

By D. L. SERVENTY, Nedlands.

During the past two decades the introduced Mediterranean or White Snail *(Helix pisana)* has become established on Rottnest Island and has spread extensively. The species is now found at most of the ports around the South-west coast, probably introduced by shipping, but in most cases is restricted within a small radius and has not extended far into the surrounding countryside.

The period when it first colonised Rottnest Island can be narrowed down to between 1925 and 1927, though in the earlier years of its introduction it was apparently inconspicuous. It was not present in January 1925, when I spent a week at the island, and it is not mentioned in my notes describing a weekend visit in March 1927. The first observer to remark on the presence of the snail was Mr. L. Glauert, of the Western Australian Museum, who found it, around the Settlement only, in August 1927. Dr. E. M. Watson, of the Perth Technical College, who is a frequent visitor to the island, told me in 1935 that the snail had evidently become prominent at Rottnest during the two years he was absent in England (1931 and 1932) as he did not remember seeing it before he left, but it had become firmly established in the Settlement area on his return.

I found the snail extraordinarily conspicuous in the north-west corner of the island in December 1935, when, during a fortnight's holiday, I decided to map its distribution, completing the survey during a weekend visit in January 1936 (Fig. 1). The centre of the area of occurrence was the Settlement, indicating this as the source of infestation. The snail had reached the far (western) end of the Causeway but had not penetrated beyond it. There was none at the main jetty, the snail in this direction having only reached to the Government House grounds.